

Another, still more preferred, embodiment of crosslinked polymer particles within the scope of the invention is formed by reactions comprising free radical addition copolymerization, in the presence of the dispersion stabilizer and in the presence of the hydrocarbon dispersing liquid, of from about 0.5 to about 20, preferably from about 2 to about 10 weight percent of ethylenically unsaturated hydroxy monomers, from about 0.5 to about 20 weight percent, preferably from about 2 to about 10 weight percent of a crosslinking monomer selected from the group consisting of amine-aldehyde resins, and from about 99 to about 60, preferably from about 96 to about 80 weight percent of at least one other copolymerizable monoethylenically unsaturated monomer.

Brief Summary Text (59):

Amine-aldehyde crosslinking agents suitable for crosslinking hydroxy functional bearing materials are well known in the art. Typically, these crosslinking materials are products of reactions of melamine, or urea with formaldehyde and various alcohols containing up to an including 4 carbon atoms. Preferably, the amine-aldehyde crosslinking agents useful in this invention with ethylenically unsaturated hydroxy monomers in particle formation are condensation products of formaldehyde with melamine, substituted melamine, urea, benzoquanamine or substituted benzoquanamine. Preferred members of this class are methylated melamine-formaldehyde resins such as hexamethoxymethylmelamine.

Brief Summary Text (60):

Particularly preferred of such amine-aldehyde crosslinking agents useful for particle formation in the invention of this application are sold by American Cyanamid under the trademark "Cymel". In particular, Cymel 301, Cymel 303 and Cymel 325 which are alkylated melamine formaldehyde resins, are useful in forming the particles of this invention.

Brief Summary Text (61):

While numerous ethylenically unsaturated hydroxy monomers will come to the mind of those skilled in the art, the preferred ethylenically unsaturated hydroxy monomers for use in either of these preferred embodiments of crosslinked particle formation are hydroxy functional acrylates and methacrylates, particularly C.sub.5 -C.sub.12 esters of acrylic or methacrylic acid bearing hydroxyl functionality, previously described for stabilizer formation of these methacrylates are especially preferred, most particularly, hydroxyethyl methacrylate.

CLAIMS:

1. A stable dispersion containing crosslinked polymer particles characterized in that they are formed by reactions comprising addition polymerization of:

(a) between about 0.5 and about 20 weight percent each of a first and second monomer selected from (i) first and second ethylenically unsaturated monomers each bearing functionality capable of crosslinking reaction with the other or (ii) first and second monomers, wherein said first monomer bears ethylenic unsaturation and functionality capable of crosslinking reaction with other functionality present on said second monomer, said second monomer bearing at least two functional groups of said other functionality and bearing no ethylenic unsaturation; and

(b) between about 99 and about 60 weight percent of at least one other monoethylenically unsaturated monomer,

in the presence of (I) an organic liquid which is a solvent for the polymerizable monomers, but a non-solvent for the resultant polymer, and (II) polymeric dispersion stabilizer, wherein the reaction is carried out at elevated temperatures such that the dispersion polymer is formed and is then crosslinked, said dispersion stabilizer comprising, on the average, more than one long hydrocarbon chain and at least one vinyl unsaturation and being the reaction product of:

(A) an adduct bearing pendant hydroxyl groups and being the reaction product of:

(a) a long chain hydrocarbon molecule bearing a carboxyl group and no other reactive group; and

(b) polyepoxide resin having (i) at least two epoxide groups and (ii) a number average molecular weight ($M_{sub.n}$) of between about 140 and 3000,

reacted in amounts so as to provide greater than about 1.0 mole of said long chain hydrocarbon molecules bearing a carboxyl group for each mole of said polyepoxide resin;

(B) saturated difunctional monomers containing the same or different first and second functional group, said first functional group being capable of reaction with said hydroxyl group of said adduct; and

(C) monomers bearing ethylenic unsaturation and bearing a functional group capable of reaction with said second functional group of said saturated difunctional monomers; wherein monomer pairs comprising said difunctional monomers (B) and said monomers (C) are selected from the group consisting of:

(i) $C_{sub.4}$ - $C_{sub.14}$ diisocyanates and $C_{sub.5}$ - $C_{sub.12}$ esters of acrylic or methacrylic acid bearing monohydroxyl functionality;

(ii) cyclic anhydride and glycidyl esters of acrylic or methacrylic acid; and

(iii) phosphorus anhydrides and glycidyl esters of acrylic or methacrylic acid.

wherein in said stabilizer formation said difunctional monomer is employed in amounts so as to provide at least about 1.0 mole of said saturated difunctional monomers for each mole of said polyepoxide resin, and wherein said difunctional monomers (B) and said monomers (C) are employed in a molar ratio of about 1:1.

9. A dispersion according to claim 1, wherein the pairs of crosslinking functionalities present on said first and second monomers used to form the particle are selected from the group consisting of (i) amine and hydroxyl; (ii) isocyanate and hydroxyl; (iii) epoxide and acid; (iv) epoxide and amine; (v) acid anhydride and hydroxyl; (vi) acid anhydride and amine.

10. A dispersion according to claim 9, wherein said particles are formed by reactions comprising free radical addition copolymerization in the presence of hydrocarbon dispersing liquid from about 0.8 to about 10 weight percent of ethylenically unsaturated hydroxy monomers, from about 1.0 to about 12 weight percent of a crosslinking monomer selected from the group consisting of ethylenically unsaturated isocyanates, and from about 98.2 to about 78 weight percent of at least one other copolymerizable monoethylenically unsaturated monomer.

11. A dispersion according to claim 9, wherein said particles are formed by reactions comprising free radical addition copolymerization in the presence of hydrocarbon dispersing liquid of from about 0.5 to about 20 weight percent of ethylenically unsaturated hydroxy monomer, from to about 99 to about 60 weight percent of at least one other copolymerizable monoethylenically unsaturated monomer, and from about 0.5 to about 20 weight percent of a crosslinking monomer selected from polyisocyanates and amine-aldehyde crosslinking resin having no ethylenic unsaturation.

12. A dispersion according to claim 11, wherein the monomers used to form the dispersed polymer particles are characterized in that said ethylenically

unsaturated hydroxy monomer is hydroxyethyl methacrylate, and said crosslinking monomer is a melamine resin.

14. Crosslinked polymer particles obtained by removal of said solvent from said dispersion in claim 1.

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